

the same species. Koch states in the older edition of his *Flora* that Linnæus included several forms in *P. domestica*, which rightfully belonged to *P. insititia*. Even this question has to be settled in Europe.

As to the non-existence of *P. insititia* in America, I agree fully with Professor Waugh, for the following reasons: If Dr. Gray had had what is known as *P. insititia* in Sweden, I doubt that he would have made it a variety of *P. spinosa*. Dr. Gray's statement that it is "adventitious in hedgerows" made me very suspicious when I saw it in his manual a year or two ago; for *P. insititia*, so far as I know, is never used for hedges. I think that *P. insititia* should be erased from the list of American plants.—P. A. RYDBERG, *New York Botanical Garden*.

NOTES ON THOREA.

(WITH PLATE XXVI)

ON October 1, 1898, Mr. A. A. Hunter, collector for the botanical department of the University of Nebraska, found specimens of *Thorea ramosissima* Bory in Rock creek, a small stream near Lincoln, Neb.¹ The plants were floating from a gravelly bottom in swift running water at a depth of half a meter and were surrounded by a mass of other algæ, principally *Vaucheria*. Subsequent search for *Thorea* in this locality has thus far proved unavailing.

So far as we know, *Thorea* has been found to a certainty in but three other localities in North America. E. Hall collected a specimen of *Thorea ramosissima* Bory in the Sangamon river, Illinois, in 1866, and this, with specimens of other fresh water algæ, was afterwards sent to the Botanical Museum of Berlin, where it is still preserved.² Francis Wolle found a mere fragment of *Thorea* in a lake at Winter Park, Florida, date not given.³ Professor De Alton Saunders,⁴ in December 1898, found *Thorea* in abundance in running water from springs in Texas, the stations being San Marcos (Hayes county), New Braunfels (Comal county), and San Antonio (Bexar county).

¹ See notice in BOT. GAZ. 27:71. 1899.

² MAGNUS: *Thorea ramosissima* Bory bei Belgrad in Serbien und deren weitere Verbreitung. Hedwigia 38:114. 1899.

³ WOLLE: Fresh water algæ of the United States, 58. 1887.

⁴ Communicated in a letter, accompanied by specimens in formalin.

Thorea is widely distributed over the world, having been reported from France, Germany, England, Denmark, Austria, Venezuela, Ecuador, Java, and the Marianne islands. In Ecuador it is said to be especially abundant.

Our description of the Nebraska plant does not differ essentially from that of Schmidle in his excellent monograph of *Thorea ramosissima* Bory.⁵ In our plant the body consists of long cylindrical branches, originating near the base, and these again have occasional branches. The color is an olive green, rather than the black or brown color mentioned by Schmidle. When dried, the plant retains its olive green color, becoming somewhat brownish. The whole plant is about 5^{dm} long, and 2 to 3^{cm} wide, when floating in the water. Each branch consists of two distinct portions, viz., an outer covering of several-celled hairs or ramelli, and a denser axial portion of interlacing cellular filaments, which are held more firmly together by a mucilaginous matrix which sheaths every fiber and extends outwards as far as the first two or three basal cells of the hairs. The surrounding zone of hairs has a width of from 400 to 600 μ , being of nearly the same diameter upon all portions of the plant body, except at the base. The axial portion has a varying diameter, ranging from 700 μ at the base to less than 100 μ at the growing point of the branch.

The hairs grow at right angles to the axis and constitute two quite distinct belts; an outer belt of quite evenly distributed long hairs, having an average length of 500 μ ; and an inner belt of clustered, short hairs of an average length of 70 to 90 μ . The long and short hairs are intermingled, and both kinds spring from the same basal cell. The short hairs are protected by gelatinous sheaths, which are extensions of the central gelatinous matrix. The cells of the long hairs are rectangular in shape, and quite uniform in diameter. The short hairs have shorter cells, which are also nearly uniform in diameter, yet in some cases they taper slightly towards the apex. In the older portions of the branches the short hairs are more numerous, while in the younger region the long hairs predominate. As the plant matures, the apical cell of the short hairs often develops into an asexual spore (aplanospore). Among the short hairs, and often from the same basal cells, there may arise narrow hairs which develop a small cluster of similar asexual spores, rarely over five in number.

⁵SCHMIDLE: Untersuchungen über *Thorea ramosissima* Bory. Hedwigia 35:1-33. 1896.

In both cases the spores when young are spherical, and when mature the former are oval, the latter pyriform.

The axis consists of three structural parts: (1) a more or less distinct outer portion, of irregular basal cells from which the hairs originate; (2) a belt of interlacing cellular fibers most of which run longitudinally in the axis; these fibers are connected either to certain hair clusters by basal cells, or in some cases to a single long hair; there are frequent oblique or transverse fibers among the longitudinal; (3) the innermost portion of the axis consisting of an interlacing mass of cellular fibers running in all directions; these are connections or continuations of the outer longitudinal and transverse fibers.

Each hair cell contains greenish, disk-shaped chromatophores, and a distinct nucleus. There is also a distinct protoplasmic connection between the cells through the center of each cell partition. The fibers near the outer edge of the axis, especially those directly connected to the hairs by basal cells, contain chlorophyll bodies more or less irregular in shape, and show in many cases intercellular protoplasmic connections similar to those in the hairs. The intercellular walls of the internal fibers are often oblique, but are always transverse in the enlarged portions. Towards the center of the axis chlorophyll bodies become rarer, and in some fibers entirely disappear.

We found, also, in the outer portion of the axis certain longitudinal fibers, which show no chlorophyll bodies, and whose protoplasmic contents seem to be homogenous. Cell partitions in these are either lacking or at considerable distances apart. These fibers branch occasionally, and are connected in a few cases to basal cells of hair clusters. Others are united to the oblique or transverse fibers. In sections which had been treated on the slide with acid alcohol to remove the gelatinous sheaths, and first stained for two or three hours with acid orseillin, then with methyl green or echtgrün for one minute, these fibers were differentiated from the others, the cell contents staining red in contrast to the thick unstained or slightly green membrane. We are unable to assign any particular function to these fibers further than that they are a portion of the assimilative axial region of the plant. The hairs are both vegetative and reproductive in function.

According to Schmidle, *Thorea* has three distinct life forms or stages of growth. The first, or prothallium stage, consists of more or less branched cellular fibers which develop directly from the spores. We found plants in this stage, but found neither spores nor tetraspores

developing from them. Schmidle found what he thought might be tetraspores, but questions their existence. The second, or Chantransia stage, develops directly from the former. The plants assume a Chantransia-like form, growing up in little dark green or brown tufts on the surface of stones, etc., at the bottom of running streams. In this stage Thorea bears asexual spores in abundance. The third and most highly developed form of Thorea is the branching plant body described above. It develops from a union and growth of a number of Chantransia-like plants into a branching thallus of greater size, yet possessing all the forms of structure found in the preceding stages, with the addition of carpogones.

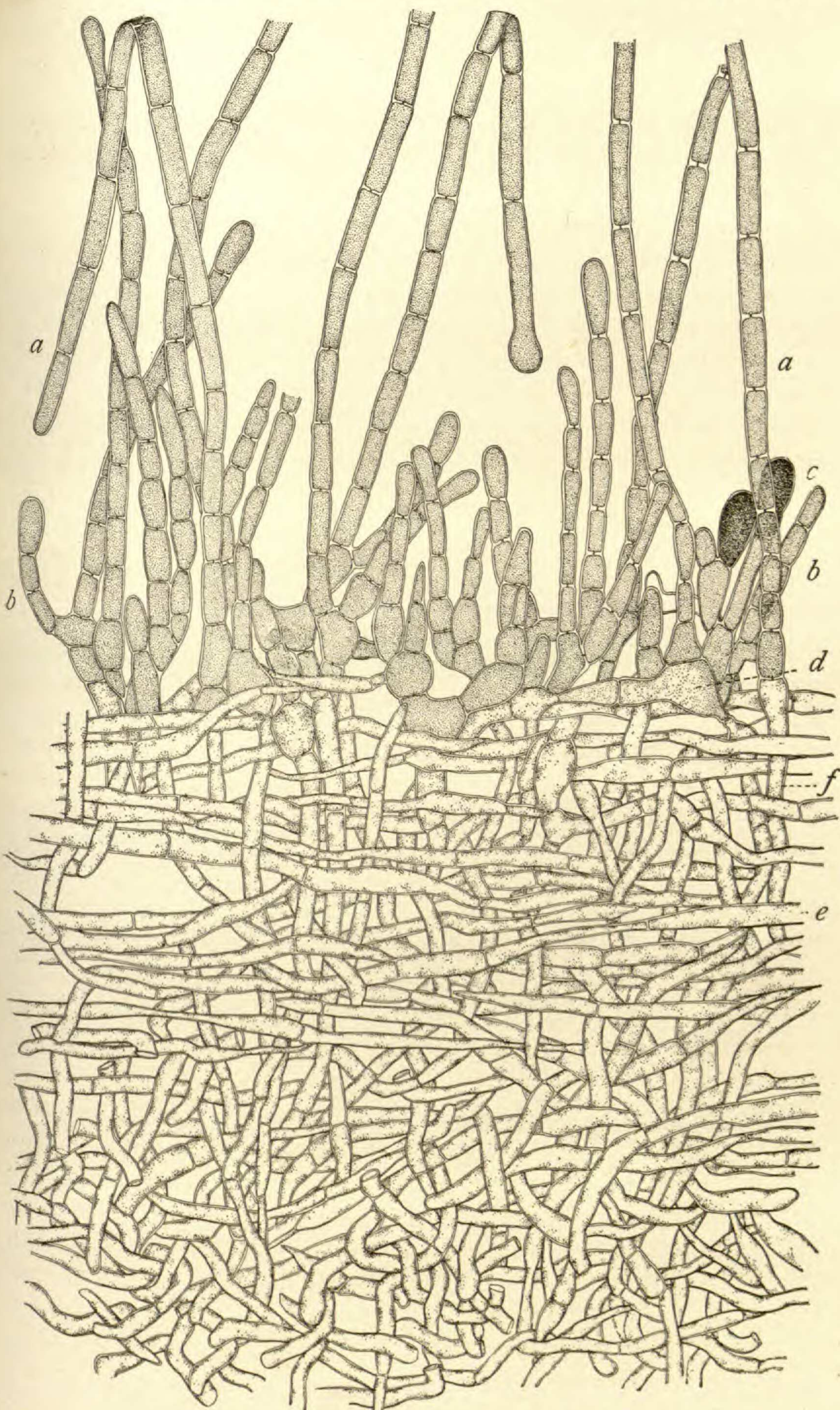
The position of Thorea was long in doubt. Moebius in 1891-2 placed it among the Florideæ.⁶ Schmitz in 1892 placed it among the Phaeophyceæ,⁷ but changed his mind in 1894⁸ and left it between this group and the Florideæ, giving preference to the latter. Schmidle, who has devoted more time to the study of Thorea than any other botanist, is certain that it properly belongs to the Florideæ for the following reasons: (1) in containing phycoerythrin, like the red seaweeds; (2) in having cystocarps resembling those of Batrachospermum; (3) in that the hair cells contain intercellular protoplasmic connections typical of many of the lower Florideæ; (4) in developing from Chantransia-like forms in much the same manner as Batrachospermum.

The Nebraska specimens of Thorea agree in points of general structure with the published descriptions of *Thorea ramosissima* Bory, with a few exceptions. The plants have a decided olive-green color which persists in the herbarium specimens, rather than the purple tinge of the dried specimens from Worms and Paris. Our Thorea branches very sparingly, the longer branches often attaining a length of 3^{dm} without side branches. On the contrary, the specimens from Worms and Paris are much branched, the diameter of the zone of hairs also being two or three times greater than that of the central portion while in ours the zone of hairs has nearly the same diameter as the central portion. There is a marked difference in the hairs as found in our material and that obtained by Professor Saunders in Texas. In the former both the long and short hairs are of nearly equal diameter

⁶MOEBIUS: Ber. d. deut. bot. Gesell. 10:333-344. 1891; 11:266-270. 1892.

⁷SCHMITZ: Ber. d. deut. bot. Gesell. 11:115-141. 1892.

⁸SCHMITZ: Nuova Notarisia 5:705-720. 1894.



HEDGCOCK and HUNTER on THOREA